

What is claimed is:

- 1 1. An optical spectrometer component comprising:
2 a fiber optic input;
3 collimating optics disposed between the fiber optic input and
4 a linear variable filter having
5 an etalon structure with
6 a tapered spacer region being tapered along a taper direction,
7 the linear variable filter being affixed to
8 a linear optical detector array disposed along the taper direction.
- 1 2. The optical spectrometer of claim 1 wherein the collimating optics
2 comprise a magnifying lens and a collimating lens.
- 1 3. The optical spectrometer of claim 1 wherein the linear variable filter
2 has
3 a first reflector comprising a first plurality of high-index layers and a first
4 plurality of SiO₂ layers, the first plurality of high-index layers alternating with the first
5 plurality of SiO₂ layers; and
6 a second reflector comprising a second plurality of high-index layers and a
7 second plurality of SiO₂ layers, the second plurality of high-index layers alternating with
8 the second plurality of SiO₂ layers wherein the tapered spacer region comprises SiO₂.
- 1 4. The optical spectrometer of claim 3 wherein at least some layers of
2 the first plurality of high-index layers comprise Ta₂O₅.
- 1 5. The optical spectrometer of claim 3 wherein at least some layers of
2 the first plurality of high-index layers comprise Nb₂O₅.
- 1 6. The optical spectrometer of claim 1 wherein the linear variable filter
2 has a thermal stability of less than 50 parts per million per degree Centigrade of ambient
3 temperature change.
- 1 7. The optical spectrometer of claim 1 wherein the linear variable filter
2 has a thermal stability of less than 25 parts per million per degree Centigrade of ambient
3 temperature change.

1 8. The optical spectrometer of claim 1 wherein the linear variable filter
2 has a thermal stability of less than 10 parts per million per degree Centigrade of ambient
3 temperature change.

1 9. The optical spectrometer of claim 1 wherein the linear variable filter
2 is a bandpass filter.

1 10. The optical spectrometer of claim 1 wherein the linear variable filter
2 is a band-edge filter.

1 11. An optical spectrometer component comprising:
2 a fiber optic input;
3 a magnifying lens disposed to expand an optical signal from the fiber optic
4 input to
5 a collimating lens, the collimating lens disposed to provide a light beam to
6 a linear variable bandpass filter having
7 an etalon structure with
8 a tapered spacer region being tapered along a taper direction,
9 the linear variable filter having a thermal stability of less than or equal to 50 parts per
10 million per degree Centigrade of ambient temperature change; and
11 a linear optical detector array disposed along the taper direction.

1 12. The optical spectrometer of claim 11 wherein the optical detector
2 array has a length along the taper direction of less than or equal to 12 mm.

1 13. The optical spectrometer of claim 11 wherein the linear variable
2 bandpass filter has a 50% bandwidth of less than or equal to about 0.6 nm at a center
3 wavelength, the center wavelength being between about 1530-1600 nm.

1 14. An optical spectrometer component comprising:
2 a fiber optic input;
3 a magnifying lens disposed to expand an optical signal from the fiber optic
4 input to
5 a collimating lens, the collimating lens disposed to provide a light beam to
6 a linear variable bandpass filter having
7 an etalon structure with

8 a tapered spacer region being tapered along a taper direction,
9 the linear variable filter having a thermal stability of less than or equal to 50 parts per
10 million per degree Centigrade of ambient temperature change and a 50% bandwidth of less
11 than or equal to about 0.6 nm at a center wavelength, the center wavelength being between
12 about 1530-1600 nm; and

13 a linear optical detector array disposed along the taper direction, the linear
14 optical detector array having a length of less than or equal to 12 mm along the taper
15 direction.

1 16. The optical spectrometer component of claim 14 wherein the linear
2 optical detector array has at least about 512 pixels so as to provide a nominal resolution of
3 the optical spectrometer component of about 3 Angstroms or less.

1 17. A method of measuring an optical signal with an optical
2 spectrometer, the method comprising:

3 calibrating an optical spectrometer component having a linear variable filter
4 with an etalon structure including at least one tapered spacer region and a detector array
5 having at least n detectors by

6 providing at least $3n$ calibration signals at $3n$ calibration
7 wavelengths to the optical spectrometer component;

8 measuring an output from each of the n detectors in response to each of the
9 calibration signals with an analyzer;

10 storing the output from each of the n detectors at each of the calibration
11 signals to create a calibration array;

12 providing an optical input signal to the optical spectrometer component;
13 measuring a second output from each of the n detectors; and
14 reconstructing the optical input signal using the calibration array in an
15 inverse transfer process to produce a reconstructed input signal.

1 18. The method of claim 17 wherein the optical spectrometer
2 component has a nominal resolution of X nm and the reconstructed input signal has an
3 equivalent resolution of better than $X/5$ nm.

1 19. The method of claim 17 wherein the optical spectrometer
2 component has a nominal resolution of less than or equal to 8 Angstroms, and the
3 calibration wavelengths are at intervals of about 0.5 Angstroms or less.

1 20. The method of claim 19 wherein the reconstructed output signal has
2 an effective resolution of less than about 1.6 Angstroms.

1 21. The method of claim 17 wherein the optical spectrometer
2 component comprises a detector array having at least 512 pixels and has a nominal
3 resolution of less than or equal to 3 Angstroms over an operating band of between about
4 1530-1600 nm.

1 22. A method of measuring an optical signal with an optical
2 spectrometer, the method comprising:

3 calibrating an optical spectrometer component having a linear variable filter
4 with an etalon structure including at least one tapered spacer region and a detector array
5 having at least n detectors to provide a nominal resolution of less than or equal to 8
6 Angstroms across an operating band of the optical spectrometer component, the operating
7 band lying within about 1530-1600 nm, by

8 providing a plurality of calibration signals to the optical
9 spectrometer component throughout the operating band at intervals of about 0.5
10 Angstroms;

11 measuring an output from each of the n detectors in response to each of the
12 calibration signals with an analyzer;

13 storing the output from each of the n detectors at each of the calibration
14 signals to create a calibration array;

15 providing an optical input signal to the optical spectrometer component;
16 measuring a second output from each of the n detectors; and

17 reconstructing the optical input signal using the calibration array in an
18 inverse transfer process to produce a reconstructed input signal having an effective
19 resolution of less than 1.6 Angstroms.

1 23. A method of monitoring an optical network, the method
2 comprising:

1 25. The method of claim 23 wherein the plurality of optical signals
2 carried on the optical network are wavelength-division-multiplexed optical signals having
3 a nominal channel spacing of less than or equal to about 200 GHz.

5 26. A optical transmission network comprising:
an input optical fiber configured to carry a plurality of wavelength-
division-multiplexed optical signals having nominal channel spacing of about 200 GHz or
less;
an output optical fiber;
an optical tap disposed between the input optical fiber and the output
10 optical fiber and configured to couple a portion of at least some of the plurality of
wavelength-division-multiplexed optical signals to
an optical spectrometer component having
a linear variable filter including an etalon structure with at least one
tapered spacer region being tapered along a taper direction, and
15 a detector array affixed to the linear variable filter; and
an analyzer coupled to the optical spectrometer component so as to monitor each of the
some of the plurality of optical signals.